NASA TECH BRIEF

Langley Research Center

Particulate and Aerosol Detector

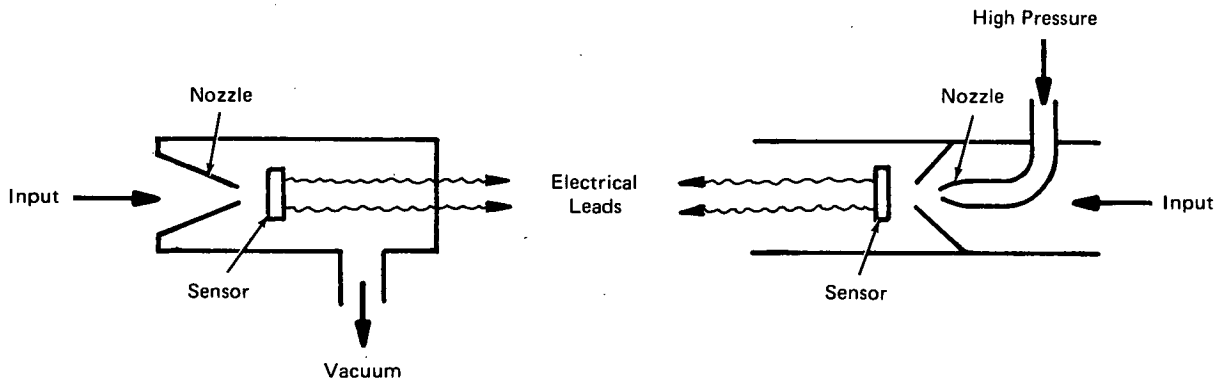

Figure 1. Accelerators

A highly efficient particulate detector has been developed for monitoring emissions from solid propellant fuels, but it could be used in any monitoring of air quality. This detector has a high signal-to-noise ratio and can count aerosols and particles with very high efficiency. With this detector, it is possible to distinguish one particle from another with respect to both time and energy of impact.

The detector consists of an accelerator, a capacitor sensor, and readout recording equipment. Two types of accelerators which have been used are shown in Figure 1. One type utilizes a vacuum pump and nozzle, to accelerate the aerosols or particles of the input sample to the sensor with sufficient energy to initiate a capacitor discharge, which can be used to classify and count the particles causing the impact. The other accelerator uses a high-pressure gas stream and nozzle for the same purpose. The capacitor sensor is of the metal-oxide-silicon (MOS) variety with thin dielectric and thin top metal electrodes (see Figure 2). The thickness of the metal electrode and dielectric determine, to a large degree, the minimum energy of particle impact which can initiate a discharge. The readout equipment is a simple binary scaler which records the number of pulses generated at the output.

That the impact of a high-velocity particle can cause a discharge in a charged capacitor is the basic principle in this detector operation. With suitable construction methods and under appropriate biasing and impacting conditions, the impacting particle can create a discharge path, through which the capacitor discharges in such a fashion as to vaporize or blow out the conducting path in the process. Once the discharge action is complete and the low-resistance path no longer exists between the capacitor plates, the capacitor again is able to accept a charge. Monitoring the voltage on the capacitor plate permits the counting of impacts simply by reading the number of discharge and recharging pulses recorded.

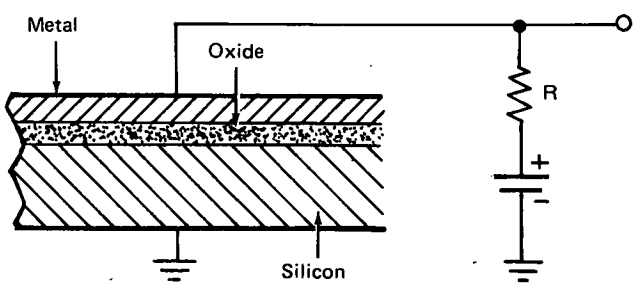

Figure 2. Capacitor Sensor and Readout Circuit

(continued overleaf)

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Langley Research Center
Mail Stop 139-A
Hampton, Virginia 23665
Reference: B73-10357

Patent status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:

Patent Counsel
Langley Research Center
Code 456
Hampton, Virginia 23665

Source: W. H. Kinard and R. L. O'Neal
Langley Research Center and
J. J. Wortman, R. P. Donovan,
A. D. Brooks, and L. K. Monteith of
Research Triangle Institute
under contract to
Langley Research Center
(LAR-11434)